REMARKS / ARGUMENTS

1.0 Rejections under 35 U.S.C. §103(a):

The Office Action rejected claims 1-11 under 35 U.S.C. §103(a) as being unpatentable over ***Straasheijm*** (U.S. Patent 6,968,009) in view of ***Ma*** (U.S. Patent 7,072,398) and in further view of ***Tomizawa*** (U.S. Patent 6,208,690).

In order to deem the Applicant's claimed invention unpatentable under 35 U.S.C. §103(a), a prima facie showing of obviousness must be made. However, as fully explained by the M.P.E.P. Section 706.02(j), to establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, ***to modify the reference*** or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, ***the prior art reference (or references when combined) must teach or suggest all the claim limitations***.

Further, in order to make a prima facie showing of obviousness under 35 U.S.C. 103(a), all of the claimed elements of an Applicant's invention must be considered, especially when they are missing from the prior art. If a claimed element is not taught in the prior art, then no prima facie case of obviousness exists. The Federal Circuit court has stated that it was error not to distinguish claims over a combination of prior art references where a material limitation in the claimed system and its purpose was not taught therein (*In Re Fine*, 837 F.2d 107, 5 USPQ2d 1596 (Fed. Cir. 1988)).

1.1 Rejection of Claims 1-11:

In the present Office Action, independent claim 1 is rejected under 35 U.S.C. §103(a) based on the suggestion that the proposed ***Straasheijm–Ma–Tomizawa*** combination reference discloses the Applicants claimed "… computer program… for

automatically estimating a motion field for image frames in an image sequence…" However, as discussed in further detail below, Applicants believe that the Office Action has misinterpreted the cited references and the elements of the claimed invention.

For example, in citing the ***Tomizawa*** reference, the Office Action states the following:

> "Tomizawa teaches that storing error values to a database the first time the MV is evaluated and then retrieving the error values instead of re-computing them reduces the number of transformations needed and eliminates the need for repeating searching motion vectors thus improving the efficiency of processing (Tomizawa: column 9, lines 39-45)."

However, column 9, lines 39-45 of the ***Tomizawa*** reference specifically recites the following language:

> "According to the present invention, it is possible to ***store prediction-error estimation values obtained by affine transformation for respective triangular areas***, thus ***reducing the number of the affine transformations*** and correspondingly saving amount of the calculating operations. This eliminates the need for repeating searching motion-vectors, thus improving the efficiency of processing." (emphasis added)

First, Applicants would like to point out that the ***Tomizawa*** reference describes various techniques involving the use of ***affine transformations*** of ***triangular areas*** of image blocks. The ***Tomizawa*** reference then obtains "prediction-error" values from the affine transformations of the triangular areas. These affine transform-based prediction-error values are then stored and recalled as necessary specifically for the purpose of "…***reducing the number of the affine transformations***…", thereby providing a

process that "eliminates the need for repeating searching motion-vectors…" as described by the ***Tomizawa*** reference.

In contrast, Applicants claim computer executable instructions that evaluate a second set of candidate motion vectors based on a computed reliability of a first set of motion vectors. It is important to understand that the Applicants neither describe nor claim the affine transformation of triangular regions of image blocks. As such, there is no equivalency between the affine transform-based "prediction-error values" and the claimed storage of error values for candidate motion vectors. Specifically, Applicants claim the following with respect to this point:

> "…***wherein evaluating the second set of one or more candidate MVs for each block further comprises computing an error value for each candidate MV and storing that error value to a database the first time that each candidate MV is evaluated, and then retrieving that error value from the database instead of re-computing the error value whenever it is necessary to evaluate any candidate MV again when evaluating MVs in neighboring blocks***…"

Further, in the Advisory Action dated February 1, 2008, the Office Action suggests that in col. 10, line 61 to col. 11, lines 35, the ***Ma*** reference "*discloses indentifying true MVs from irregular, or non-reliable, MVs. Ma then discloses at a second level, identification or evaluation using the irregular MVs*."

However, it should be clear that col. 10, line 49 through col. 12, line 11 of the ***Ma*** reference describes a ***filtering process*** used to provide "motion-vector field denoising." In general, the filtering process requires the identification of ***multiple types of motion vectors*** including: 1) "true MVs"; 2) "irregular MVs"; 3) "isolated irregular MVs"; 4) "non-isolated irregular MVs"; and 5) "edge MVs". The various types of MVs described by the ***Ma*** reference are then used in defining filter parameters (see col. 12, lines 12-40 of the

Ma reference) that are used to provide motion field denoising operations. Consequently, it should be clear that in contrast to the position advanced by the Advisory Action, the ***Ma*** reference does ***not*** disclose "*...a second level, identification or evaluation using the irregular MVs...*"

In addition, as explained in the Applicants prior responses, Applicants also maintain that the Office Action has also mischaracterized both the ***Straasheijm*** and ***Ma*** references. For example, in the present Office Action, the Examiner makes the following two points in maintaining the rejections under 35 U.S.C. §103(a):

1) "The examiner relied upon Straasheijm to teach evaluating a second and third set of MV's in which Straasheijm discloses in figure 5 and column 4, lines 42-54."

2) "The examiner relied upon MA to teach MV's that are deemed not reliable in which Ma discloses in column 8, lines 1-5. If the error is less than a threshold, the search ends. However, for values higher than the threshold, the processing does not stop."

In making the two arguments presented above, it is clear that the cited art has been mischaracterized by the Office Action in an attempt to show some equivalency to the claimed invention.

In particular, with respect to the first point raised above with respect to the ***Straasheijm*** reference, in the prior response, Applicants explained that the ***Straasheijm*** reference discloses computing a rough or initial estimate of motion vectors (MVs) using a "rough search" of a low resolution scaled image frame. This rough search is then refined in a second search of a higher resolution scaled image frame. Finally, a third level search refines the results of the second level search by using those results to guide the search of a full resolution image frame.

This three level search is fully detailed in FIG. 5 of the ***Straasheijm*** reference and in col. 4, lines 3-55. In particular, FIG. 5 includes "STEP 0", 'STEP 1", "STEP 2(i)", and "STEP 2(ii)". The descriptions of these steps, as described in col. 4, lines 3-55 are summarized below:

1. STEP 0: Given a full resolution image frame, generate two scaled frames of successively lower resolution than the full image frame.

2. STEP 1: Search the lowest resolution scaled image frame to identify rough MVs in the lowest resolution image frame.

3. STEP 2(i): Search the higher resolution scaled image frame using the rough MVs identified in STEP 1 to identify intermediate MVs in the higher resolution scaled image frame.

4. STEP 2(ii): Search the full resolution image frame using the intermediate MVs identified in STEP 2(i) to identify final MVs in the full resolution image frame.

It is very important to understand here that the ***Straasheijm*** reference is simply using MVs identified in a low resolution image frame to guide a search for corresponding MVs in successively higher resolution copies of the same image frame. ***In fact, only those MVs that are actually identified as valid MVs in a low resolution image frame are used to guide the search in the next higher resolution copy of that image frame***.

Next, with respect to the ***Ma*** reference, the Office Action specifically explains that "The examiner relied upon MA to teach MV's that are deemed not reliable in which Ma discloses in column 8, lines 1-5. If the error is less than a threshold, the search ends. However, for values higher than the threshold, the processing does not stop." In other

words, the Office Action is clearly explaining that the ***Ma*** reference ***terminates the MV search*** whenever the error is less than a threshold, or continues the search otherwise.

However, as disclosed in column 8, lines 1-9, of the ***Ma*** reference, ***Ma*** teaches that a "matching error" of a block of an image frame is less than the "threshold," then the "***the search ends… for the current block…***" (emphasis added). In other words, whenever a particular match is so poor that its "matching error" falls below the "threshold," the search of that block is terminated. This concept described by the ***Ma*** reference is very simple: ***the search ends whenever the match is below a threshold***.

Apparently, the Examiner considers matches below the threshold to be equivalent to the claimed ***unreliable motion vectors***. Applicants disagree with the specific interpretation of the ***Ma*** reference advanced by the Office Action. However, for the sake of argument, Applicants will address this argument in the following paragraphs.

In particular, ***Straasheijm*** identifies ***valid*** (presumably reliable) motion vectors in a low resolution copy of an image. Combining this concept with ***Ma's*** termination of the block search for matches below the threshold will presumably not change the results of the ***Straasheijm*** first level search since ***Straasheijm*** intends to provide only valid or reliable rough motion vectors for the next level search. This process then repeats for two more search levels with successively higher resolution copies of the same image frame. Again, ***Straasheijm–Ma–Tomizawa*** will pass only reliable motion vectors to the next level search, with those reliable motion vectors being used to guide the next level search.

However, in stark contrast to the ***Straasheijm–Ma–Tomizawa*** combination reference, Applicants specifically identify those blocks "…***for which the first set of zero valued MVs was deemed not reliable***..." Applicants then ***continue the search of the unreliable blocks*** by "…***evaluating a second set of one or more candidate***

MV…" for those unreliable blocks. As claimed by the Applicants, a similar search is then performed using a third set of MV's for unreliable blocks of the second search.

Clearly, Applicants claim a technique which includes specifically ***continuing*** to search ***subsequent sets of motion vectors for unreliable blocks***. Conversely, ***Ma terminates*** searches for blocks matches below the threshold. Therefore, ***Ma*** specifically teaches termination of further search in the exact instance where Applicants specifically claim continuation of the search. These two concepts are clearly diametrically opposed. In other words, the proposed ***Straasheijm–Ma–Tomizawa*** combination reference ***teaches termination of searching*** where Applicants claim ***continuation of searching***. Therefore, the proposed ***Straasheijm–Ma–Tomizawa*** combination specifically teaches away from the claimed invention and specifically fails to disclose the claimed invention.

Thus, it is clear that the present invention, as claimed by independent claim 1 includes elements ***not taught*** in the proposed ***Straasheijm–Ma–Tomizawa a*** combination reference, or in any way rendered obvious by the proposed ***Straasheijm–Ma–Tomizawa*** combination reference. Consequently, the rejection of independent claim 1 and of dependent claims 2-11, under 35 U.S.C. §103(a) is not proper. Therefore, the Applicants respectfully traverse the rejection of claims 1-11 under 35 U.S.C. §103(a), and respectfully request reconsideration of the rejection of these claims in view of the novel language of claim 1. In particular, claim 1 recites the following novel language:

> "A computer-readable medium encoded with a computer program having computer executable instructions for automatically estimating a motion field for image frames in an image sequence, said computer executable instructions comprising:

evaluating a first set of zero valued motion vector (MVs) for blocks in an image frame using background detection and determining a reliability of each MV;

evaluating a second set of one or more candidate MVs for each block in the image frame for which the first set of zero valued MVs was deemed not reliable, said second set of MVs being determined using any of spatial and temporal neighbors of each of those blocks, and determining an optimal MV for each block of the second set and a reliability of each optimal MV;

wherein evaluating the second set of one or more candidate MVs for each block further comprises computing an error value for each candidate MV and storing that error value to a database the first time that each candidate MV is evaluated, and then retrieving that error value from the database instead of re-computing the error value whenever it is necessary to evaluate any candidate MV again when evaluating MVs in neighboring blocks;

evaluating a third set of candidate MVs for all blocks in the image frame having MVs that were deemed not reliable using the first or the second set of MVs, said third set of MVs being determined using a block-based pattern search, and determining an optimal MV for each block of the third set; and

outputting an optimal MV for each block using the reliable MVs from the first, second and third sets of MVs to form a motion field for the image frame." (emphasis added)

CONCLUSION

In view of the above, it is respectfully submitted that claims 1-11 are in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of claims 1-11 and to pass this application to issue. Additionally, in an effort to further the prosecution of the subject application, the Applicant kindly invites the Examiner to telephone the Applicant's attorney at (805) 278-8855 if the Examiner has any questions or concerns.

Respectfully submitted,

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